**Edexcel - Foundation**

Algebra

2022 GCSE Advance Information

Sparx Topics & Key Questions

We are always looking for ways to support maths teachers and students. In order to help you and your year 11s this year we've pulled together a list of key questions which may be useful to practise with your students based on the exam board topic lists.

These 89 key questions are all taken from our library of over 45,000 high-quality questions in Sparx Maths. If you are a Sparx Maths School then your students can use the Topic Codes provided to search the full content library directly within the independent learning section of Sparx Maths to help target their revision.

Please note this is not an exhaustive topic guide it is simply designed to help you pull together some key questions to use to check for understanding in lessons, starters, or as worksheets with your learners.
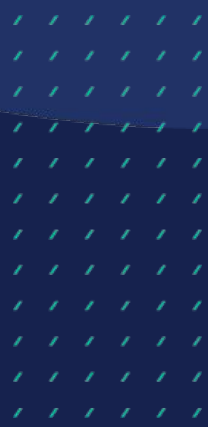
Algebra	Topics	Sparx Topic Codes
Manipulation	Simplification	U105, U662
	Expansion of bracket	U179, U768
	Factorisation	U365, U178
	Substitute values	U585, U144
	Change subject of a formula	U556
	Forming an expression	U613
	Laws of indices	U662
Equations and inequalities	Linear equation	U755, U325, U870
	Linear inequality	U509, U759, U738, U337
	Linear simultaneous equations	U760, U757, U836, U137
	Form an equation	U599
	Quadratic equation	U228
Graphs	Coordinates	U789, U889
	Straight line graph	U741, U315, U669, U638, U862, U652
	Quadratic graph	U601, U989, U667
Functions	Number machines	M175, M428
Sequences	Linear sequence	U213, U530, U498, U978

Manipulation - Simplification

Simplifying expressions by collecting like terms   **U105**

Fully simplify the expression below.

$$5x + 8y + 2x + 6 - 8y$$

Fully simplify $8a + 7d - 3a + 2v - 5d + 4v$

Fully simplify the expression below.

$$5b^2 + 3r^2 + 7b^2 + 4r$$

Fully simplify $2cw + 6c + 5wc + 3c$

Simplifying expressions using index laws   **U662**

Simplify $\dfrac{b^{28}}{b^7}$

Simplify $\left(m^3\right)^5$

Manipulation - Expansion of bracket

Expanding single brackets
U179

Expand $u(u - 11)$

Expand and simplify $5(x + 7) + 2(3x - 4)$

Expanding double brackets
U768

Expand and simplify $(3x + 5)(x + 7)$

Manipulation - Factorisation

Factorising into one bracket   **U365**

Fully factorise $7c^2 + 11c$

Factorising quadratic expressions of the form $x^2 + bx + c$ **U178**

Factorise $h^2 + 11h + 28$ fully

Fill in the gaps to factorise this expression.

$$x^2 + 3x - 10 = (x - \underline{\quad})(x + \underline{\quad})$$

Manipulation - Substitute values

Substituting into algebraic formulae   **U585**

What is the value of d when $d = \frac{3t}{4} + 4$ and $t = 8$?

What is the value of h when $h = 8n^2$ and $n = 3$?

What is the value of $3a + 2b$ when $a = 5$ and $b = -3$?

If $y = 31 + x^2$, find the value of y when $x = -2$

If $y = 11$ when $x = 3$, what number goes in the box?

$$y = 2x + \boxed{}$$

Substituting into real-life formulae   **U144**

An electricity company uses the formula below to calculate bills.
How much is Freya's bill if she uses 250 units of electricity? Give your answer in pence (p).
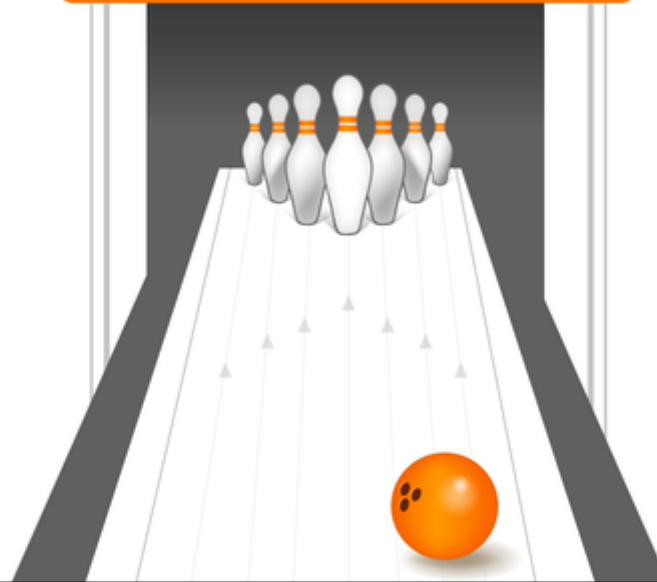
$$c = 17n + 12$$

c = total cost in pence

n = number of units of electricity

A bowling alley can be hired for a party. The formula below shows the cost.

A party cost $£332$. How many people were at the party?

Brilliant Bowling

cost = £11 × the number of people + £35

Manipulation - Change subject of a formula

Changing the subjects of formulae   **U556**

Make n the subject of this formula:

$$w = an + z$$

Make k the subject of $d = \frac{k+m}{2}$

Manipulation - Forming an expression

Using algebraic notation   **U613**

Write an expression that has a value of 5 more than t

A shop sells bags of marbles. Each bag contains n marbles.

Write an expression for the total number of marbles in 7 of these bags.

Write the following expressions as simply as possible:

a) $3n \times 7p$

b) $2 \times c \times d \times 8$

Sparx Maths

Manipulation - Laws of indices

Simplifying expressions using index laws   **U662**

Simplify $\dfrac{b^{28}}{b^7}$

Simplify $(m^3)^5$

Equations and inequalities - Linear equation

Solving equations with one step   **U755**

Find the value of y in the equation below, giving your answer as a decimal.

$$y - 5.3 = 14.2$$

Find the value of v in the equation below.

$$v + 16 = 53$$

What is the value of y in this equation?

$$40 = 10y$$

Solve $\frac{x}{8} = -2$

$$x = \dots$$

Work out the value of b using the equations below.

$$a - 14 = 22$$

$$b + 7 = \frac{a}{3}$$

Solving equations with two or more steps **U325**

Solve $13 = 3x - 5$

$$x = \ldots$$

Find the two values that x can have if $x^2 - 12 = 37$

Solve $\frac{x}{2} + 7 = 3$

$$x = \ldots$$

Work out the value of y in the equation below.

$$4 = \frac{y+2}{3}$$

Solving equations with the variable on both sides   **U870**

Solve $4m + 5 = 35 - 2m$

$m = ...$

Equations and inequalities - Linear inequality

Reading and drawing inequalities on number lines   **U509**

Work out which number line below shows the values that x can take if $x \geq 3$.

A
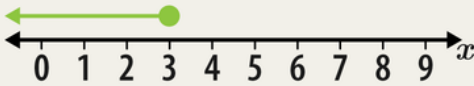
B
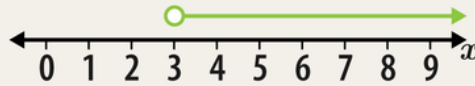
C
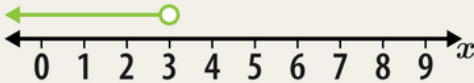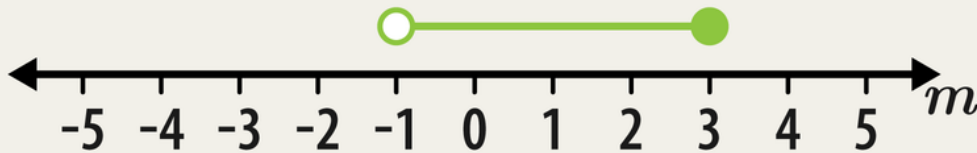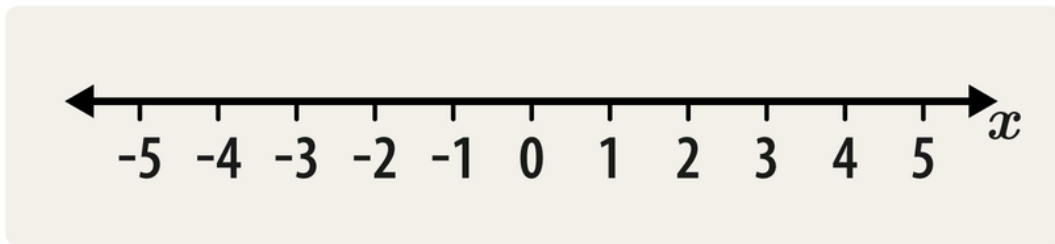
D
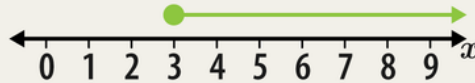
Write down the inequality shown on the number line below.

Copy down the number line below.

Draw the inequality $-1 \leq x < 2$ on your number line.

Solving single inequalities   **U759**

Solve the following inequality:

$$3k + 8 \geq 26$$

Solving inequalities with the variable on both sides   **U738**

Solve this inequality:

$$5f - 4 > 38 - 2f$$

Constructing and solving inequalities   **U337**

Samuel thinks of a number, k. He triples it and then subtracts 11 to get an answer that is less than 43.

a) Write an inequality to represent this.

b) Solve your inequality to find the possible values of k.

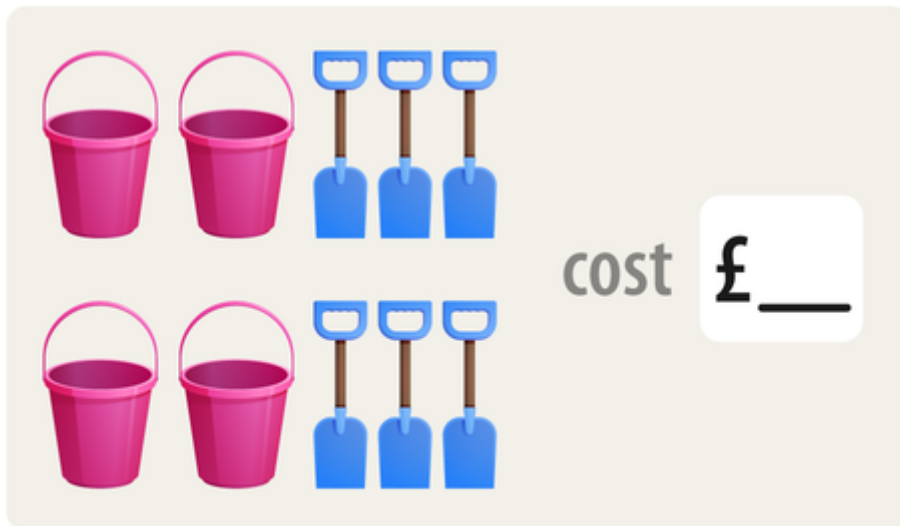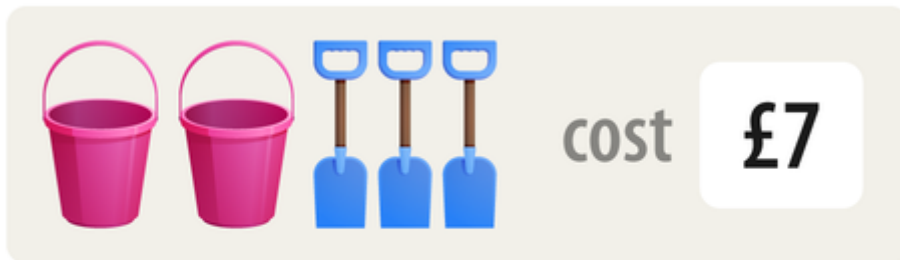# Equations and inequalities - Linear simultaneous equations

Solving simultaneous equations using elimination   U760

What number completes the sentence below?

The cost of 2 buckets and 3 spades is $£7$.
The cost of 4 buckets and 6 spades is $£\underline{\quad}$.

cost £7

cost £___

The cost of 1 hat and 1 bag is £27.

The cost of 2 hats and 1 bag is £42.

a) How much does 1 hat cost?

b) How much does 1 bag cost?

cost **£27**

cost **£42**

Solve the simultaneous equations below.

$$7x - 4y = 20$$
$$2x + 4y = 16$$

Solve this pair of simultaneous equations:

$$6y + 7x = 50$$
$$6y + 5x = 34$$

Work out the value of x and the value of y in the simultaneous equations below.

$$2x + 3y = 8$$
$$3x + 4y = 11$$

Solving simultaneous equations using substitution   **U757**

Look at the simultaneous equations below.

$$(1) \qquad 18 = 6x - y$$
$$(2) \quad 4x + y = 2$$

a) Rearrange equation (1) to make y the subject.

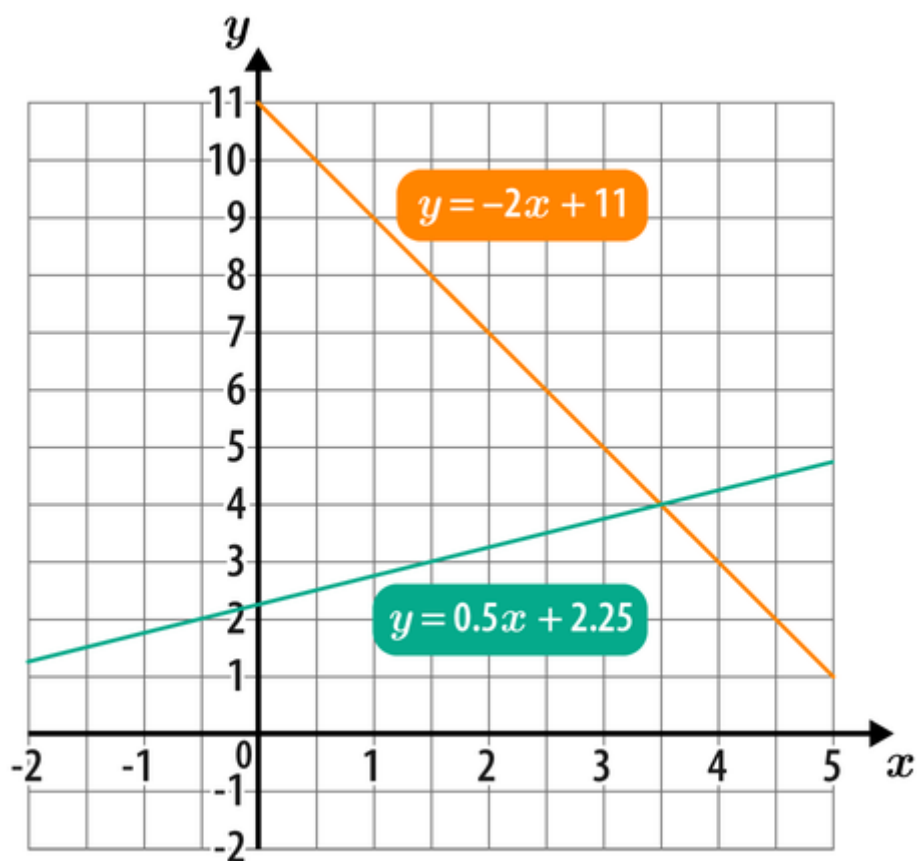b) Using your answer to part a), solve the simultaneous equations.

Solving simultaneous equations graphically   **U836**

Use the diagram to work out the solution to these simultaneous equations:
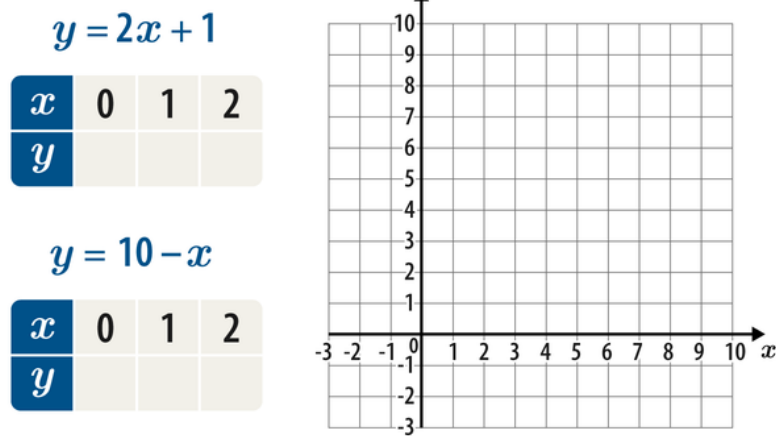
$$y = -2x + 11$$
$$y = 0.5x + 2.25$$

Copy the axes below.

a) By completing the tables of values to help you, plot the lines $y = 2x + 1$ and $y = 10 - x$ on your axes.

b) Use your diagram to find the solution to the simultaneous equations $y = 2x + 1$ and $y = 10 - x$.

$y = 2x + 1$

x	0	1	2
y			

$y = 10 - x$

x	0	1	2
y			

Constructing and solving simultaneous equations   **U137**

The cost of 2 footballs and 3 tennis balls is $£21.73$.

The cost of 5 footballs and 7 tennis balls is $£53.20$.

Work out the cost of
a) a tennis ball.
b) a football.

Equations and inequalities - Form an equation

Constructing and solving equations   **U599**

Lilly thinks of a number, k. She triples it and then subtracts 8 to get an answer of 7.

a) Write an equation to describe this.

b) Use your equation to calculate k.

Equations and inequalities - Quadratic equation

Factorising to solve quadratic equations of the form $x^2 + bx + c = 0$ **U228**
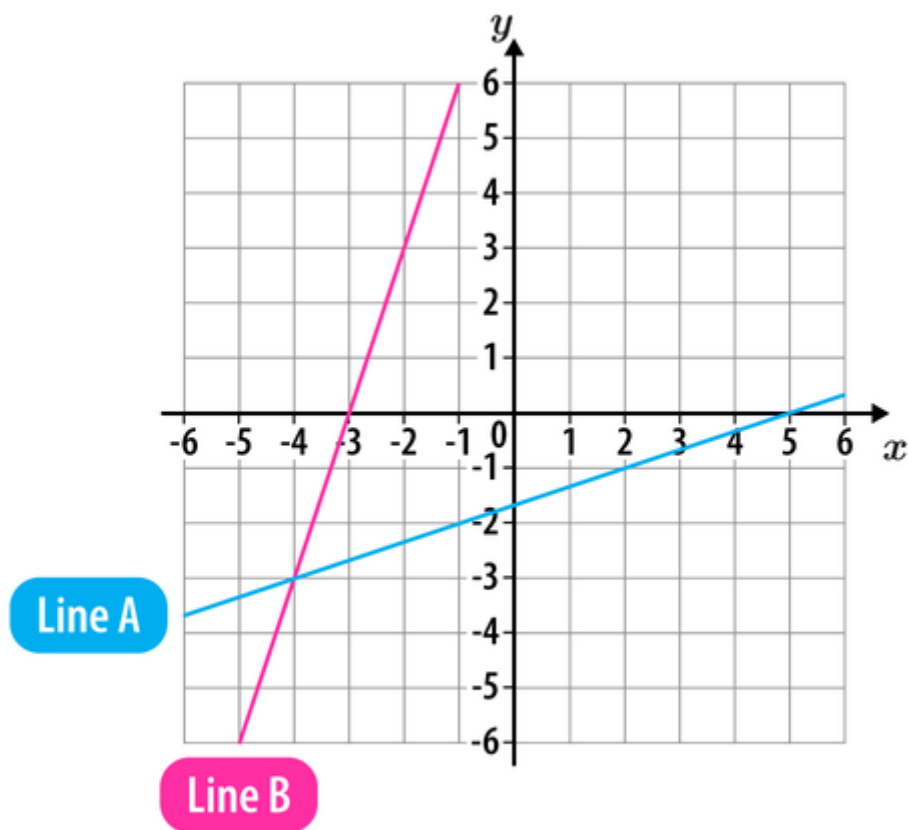

Solve this equation by factorising:

$$y^2 + 5y - 14 = 0$$

Graphs - Coordinates

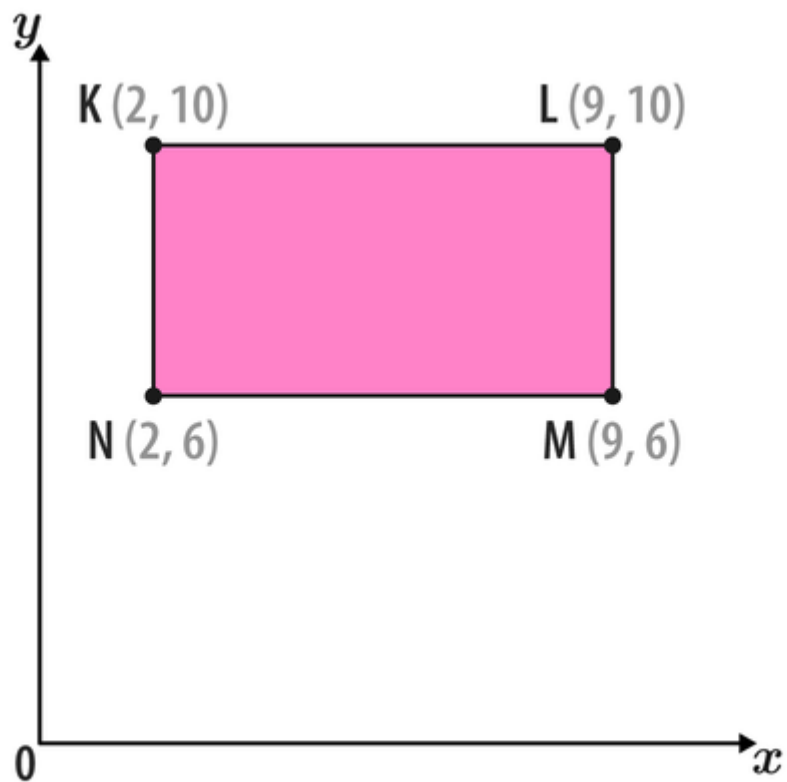**Reading and plotting coordinates**   **U789**

What are the coordinates of the point where line A and line B intersect?

Solving shape problems involving coordinates   **U889**

What is the perimeter of the rectangle KLMN shown below?

K (2, 10)   L (9, 10)

N (2, 6)   M (9, 6)

Not drawn accurately

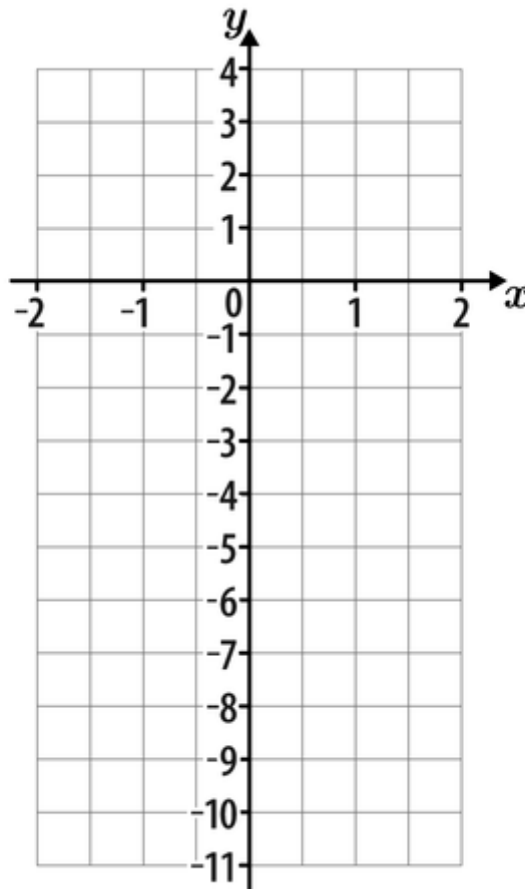## Graphs - Straight line graph

Plotting straight line graphs   **U741**

Copy the axes below.

By first filling in the table for $y = 3x - 5$, draw the graph of $y = 3x - 5$ on your axes.

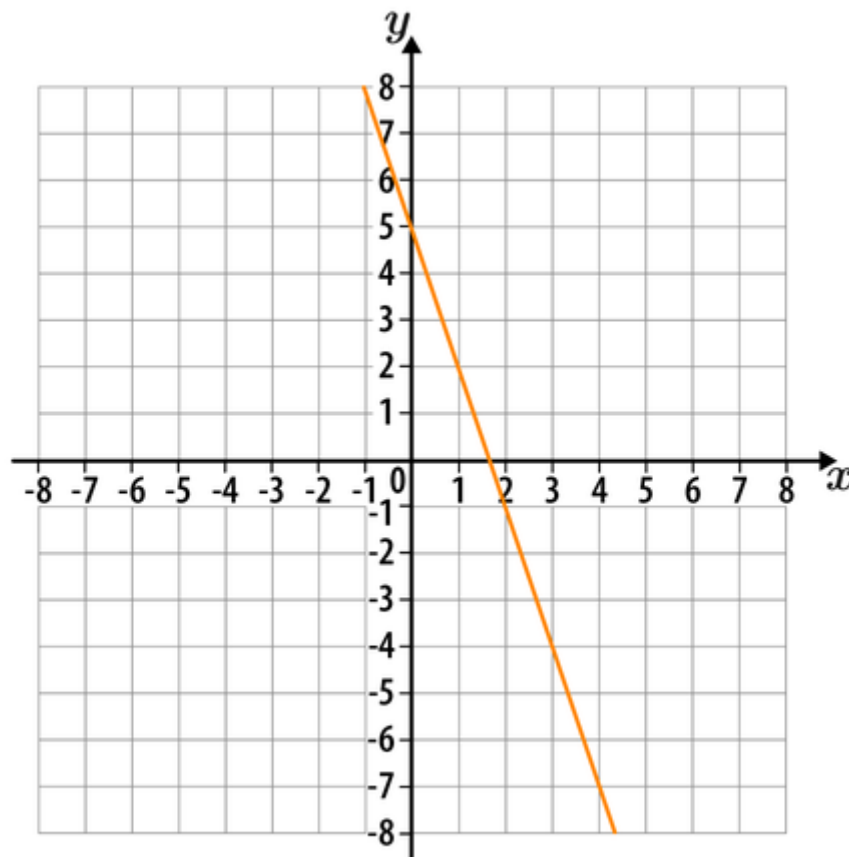| x	-2	-1	0	1	2
y		-8	-5		1

For the line $y = 6x + 3$, create a table to show the values of x and y where x is between -1 and 3.

Finding equations of straight line graphs   **U315**
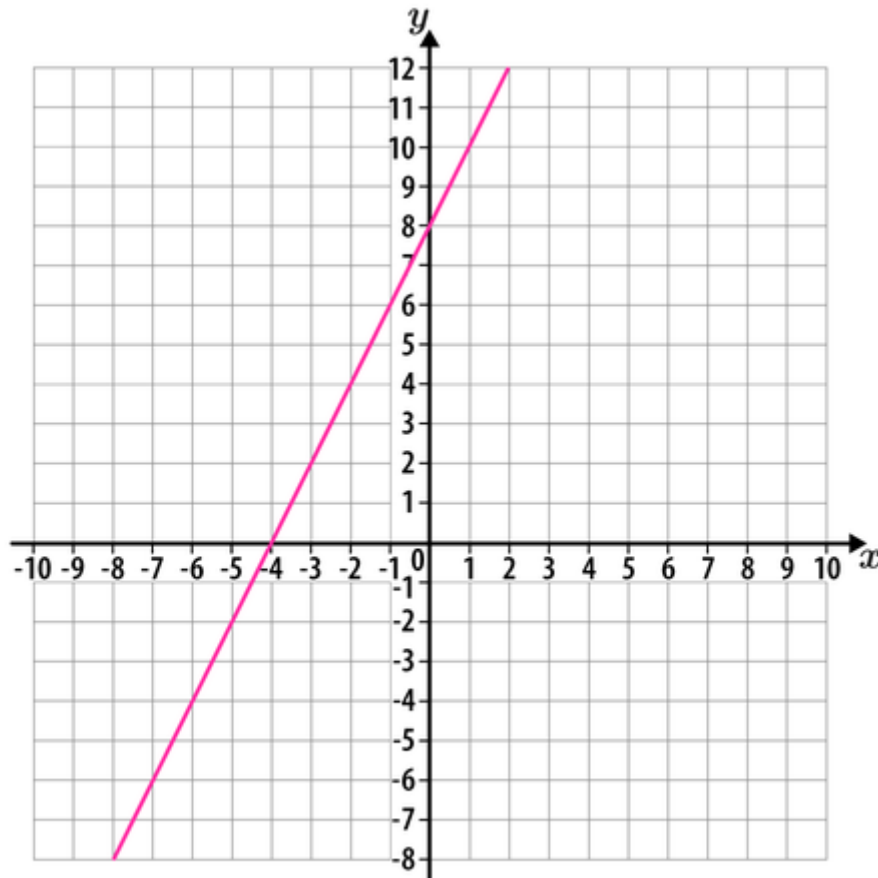
What is the gradient of the straight line shown below?

Give your answer as an integer or as a fraction in its simplest form.

What is the equation of the straight line shown below?

Give your answer in the form $y = mx + c$, where m and c are integers or fractions in their simplest forms.

Interpreting equations of straight line graphs

U669

The equation of a line is $y = 19x - 8$

What are the coordinates of the point where the line crosses the y-axis?

The equation of a line is $y + 4 = 6x + 11$

What is the value of y at the point where the line crosses the y-axis?

What is the gradient of the line described by the equation below?

$$y + 11x = 4$$

Find the equation of the straight line with a y-intercept of 2 and a gradient of 12.

Give your answer in the form $y = mx + c$

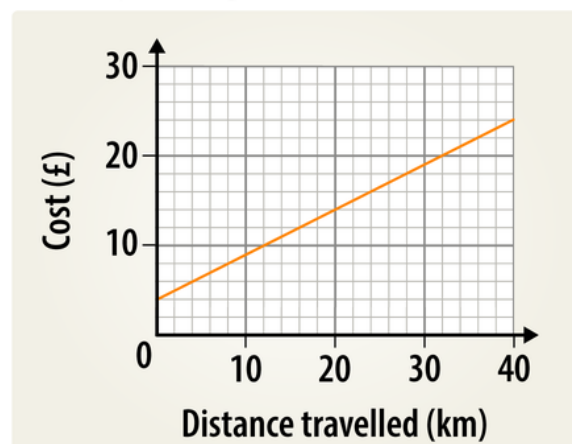**Using and interpreting linear real-life graphs**   **U638**

Look at the graph below.

How much would it cost to get an item delivered if the distance travelled was $24 \, \text{km}$?
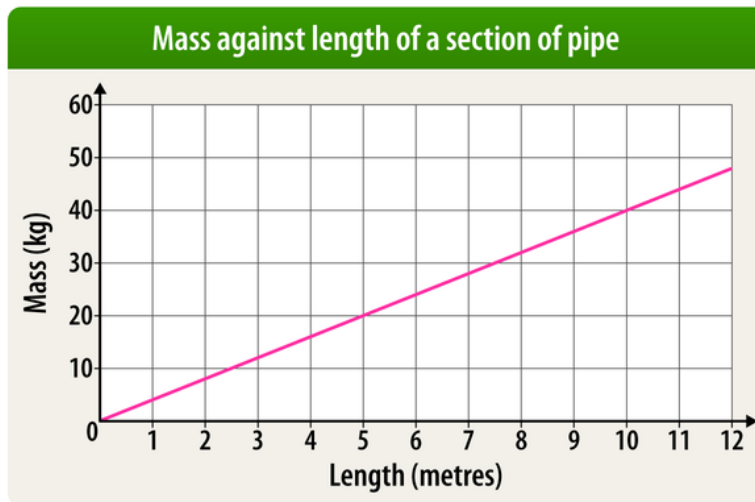Give your answer in pounds $(£)$.

Delivery cost against distance travelled

The mass of a section of pipe depends on its length.

If the graph continues in the same way, how long is a section of pipe with a mass of $120 \, \text{kg}$?
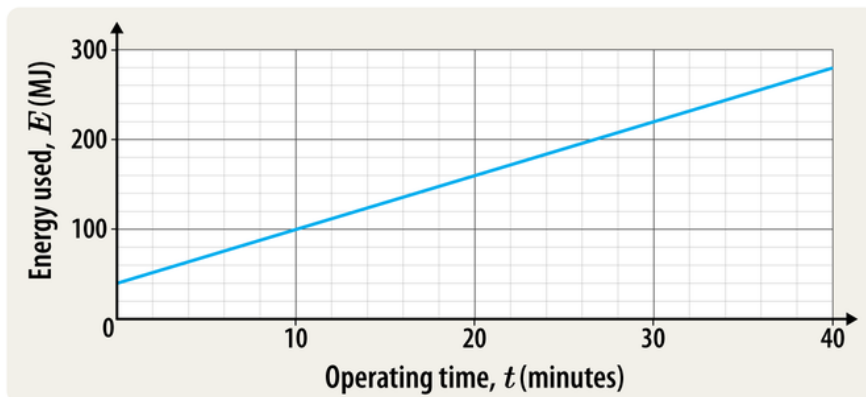
Mass against length of a section of pipe

Finding equations of linear real-life graphs   **U862**

The graph below shows how the energy used by a machine in a factory changes based on how long it operates for.

Work out the values that complete the formula.
If your answers are decimals, give them to 1 d.p.

$$E = \boxed{} \, t + \boxed{}$$

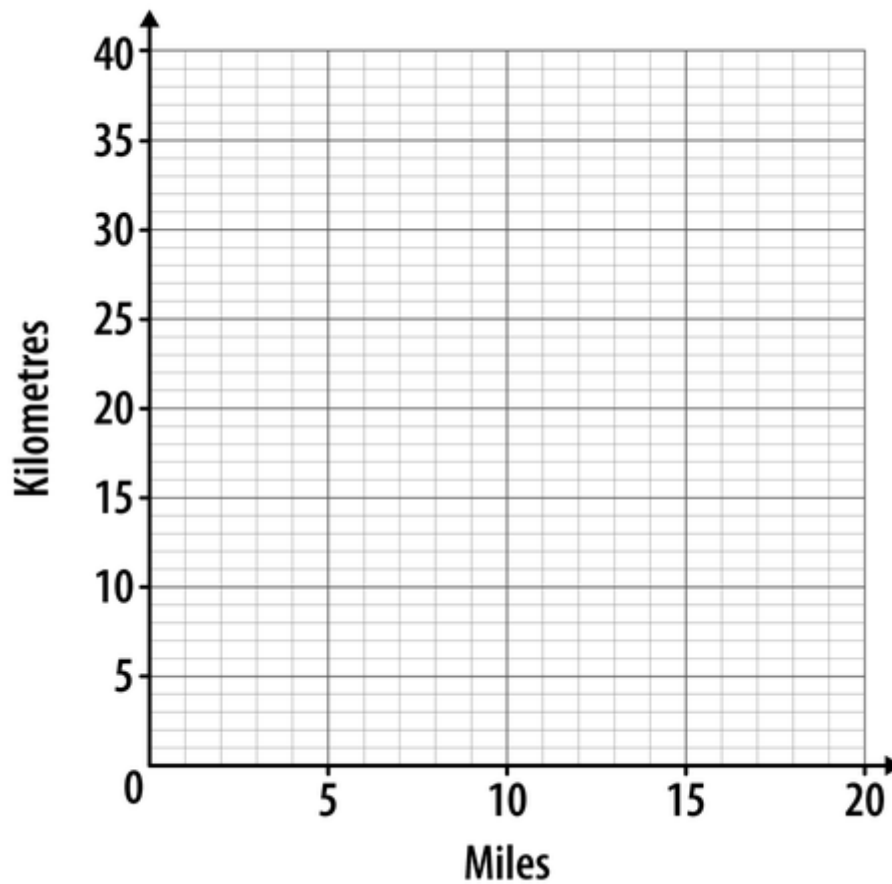**Plotting linear real-life graphs**   **U652**

$5 \text{ miles} = 8 \text{ kilometres}$

The graph showing the relationship between miles and kilometres is a straight line.

a) When plotted on the axes below, the points $(0, m)$ and $(5, n)$ are on this line. Work out the values of m and n.

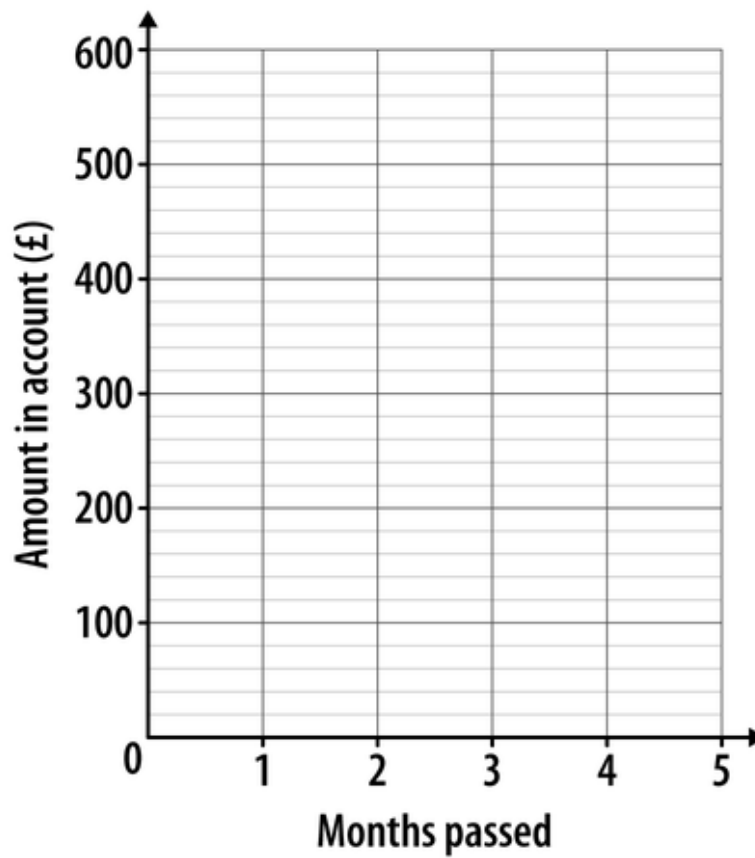b) Use your answer to part a) to plot this line.

A bank account contains £500.

£80 is withdrawn from the account during each month.

a) Copy and complete the table of values below.
What values replace A, B, C and D?

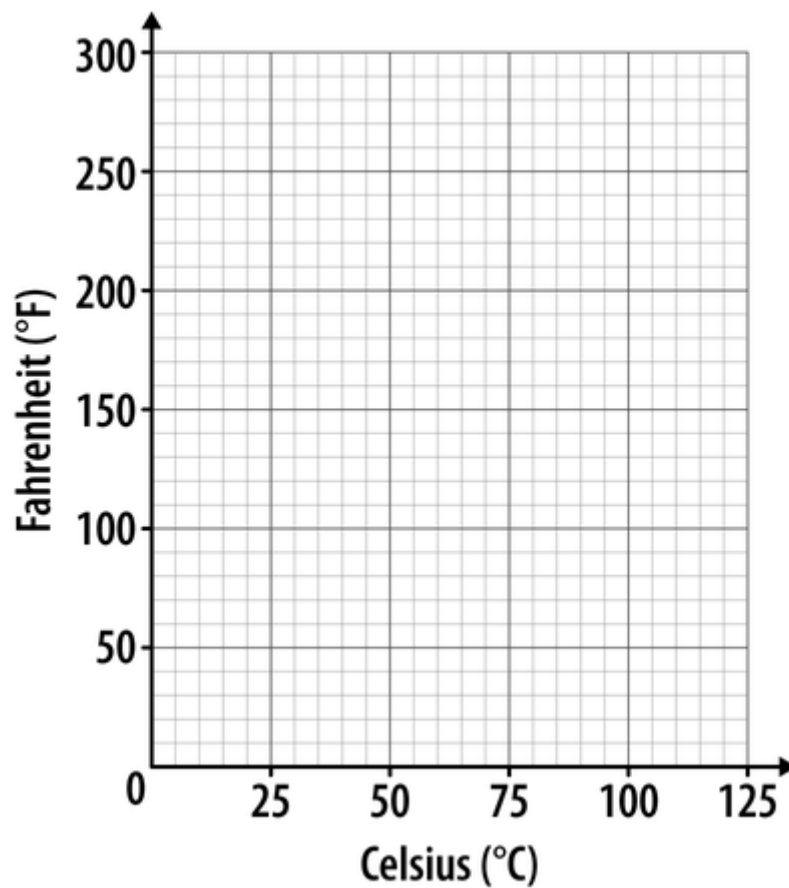| Months passed	0	1	2	3
Amount in account ($£$)	A	B	C	D

b) Plot this relationship on a copy of the axes below.

The conversion graph between temperature in Celsius $(°\text{C})$ and Fahrenheit $(°\text{F})$ is a straight line.

The freezing point of water is $0°\text{C}$ or $32°\text{F}$.
The boiling point of water is $100°\text{C}$ or $212°\text{F}$.

Copy the axes below and plot a conversion graph between Celsius $(°\text{C})$ and Fahrenheit $(°\text{F})$.
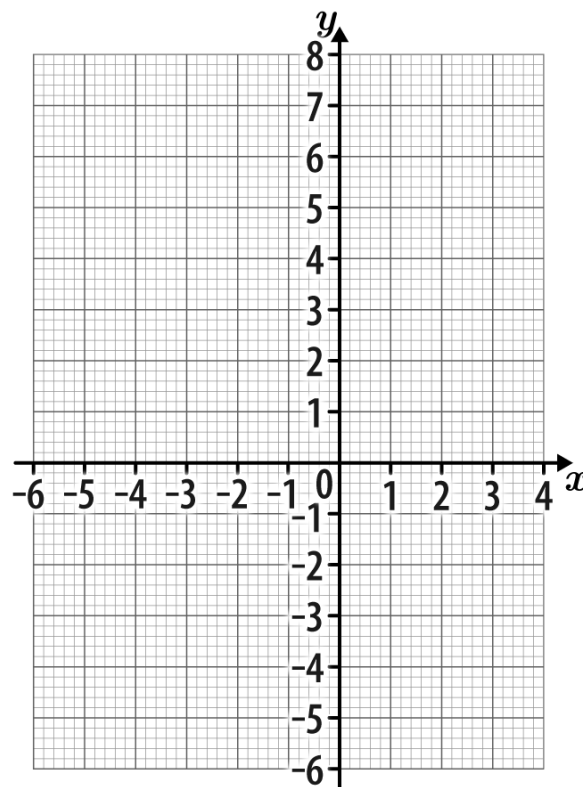
Graphs - Quadratic graph

Solving quadratic equations graphically   **U601**

Copy these axes on to graph paper.

Copy and complete the table below and use it to plot the graph of $y = x^2 + 3x - 3$.

x	-5	-4	-3	-2	-1	0	1	2
y	7	1	-3	-5				

Use your graph to estimate solutions to the equation $x^2 + 3x - 3 = 0$.

Give your answers to 1 decimal place.
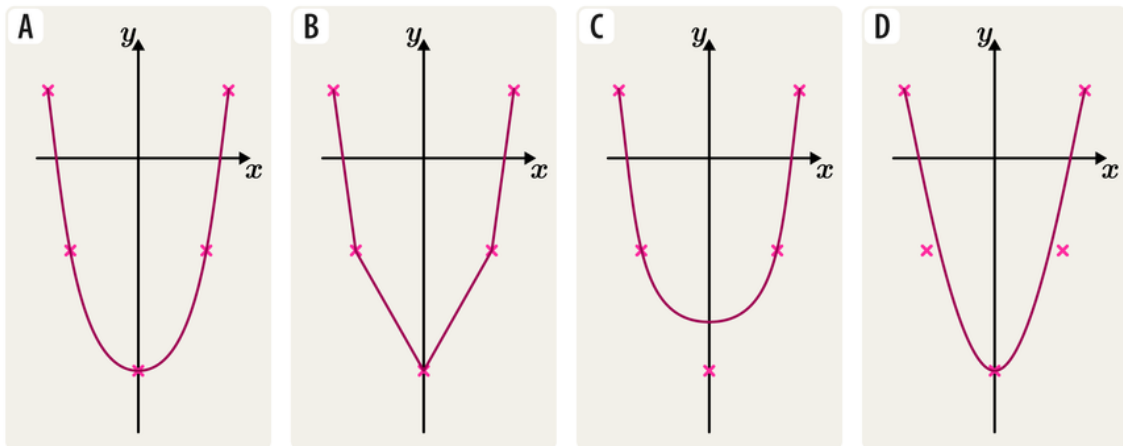

Plotting graphs of quadratic functions   **U989**

Copy and complete the table of values for $y = x^2 + 3x - 2$.

What numbers replace A, B and C?

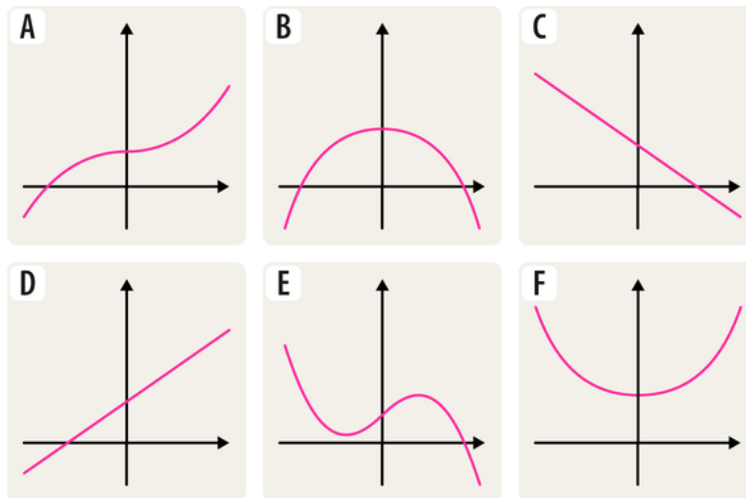| x	-3	-2	-1	0	1
y	A	-4	-4	B	C

Which of these options shows a correctly drawn quadratic graph?

Interpreting graphs of quadratic functions   **U667**
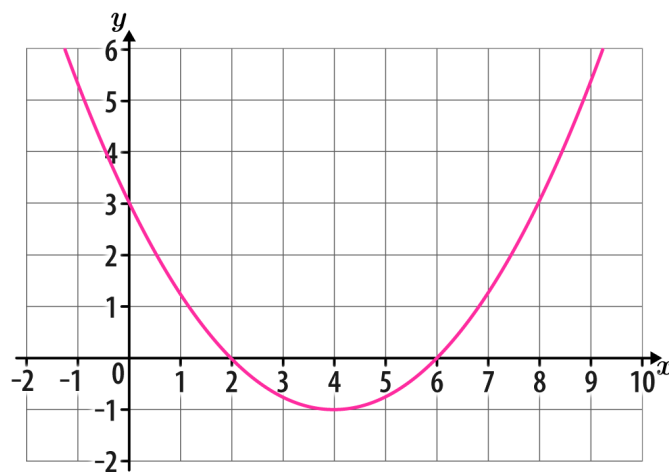

Which two of these are graphs of **quadratic** functions?

A

B

C

D

E

F

The x-intercepts of a quadratic curve are also known as the **roots** of the equation.

Write down the coordinates of the roots of the quadratic curve shown below.
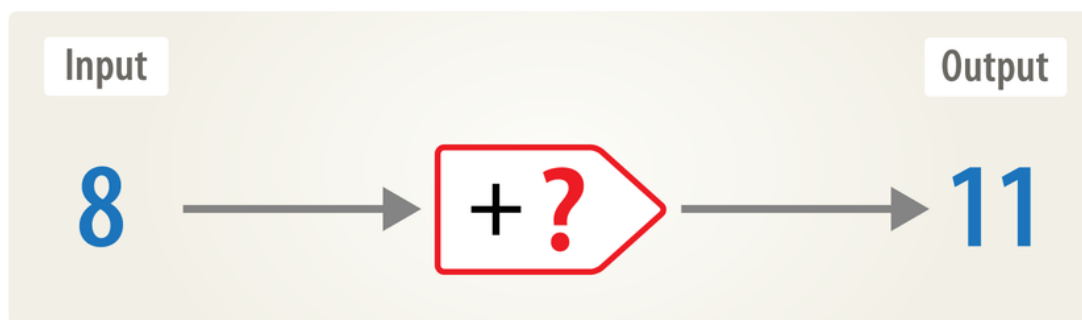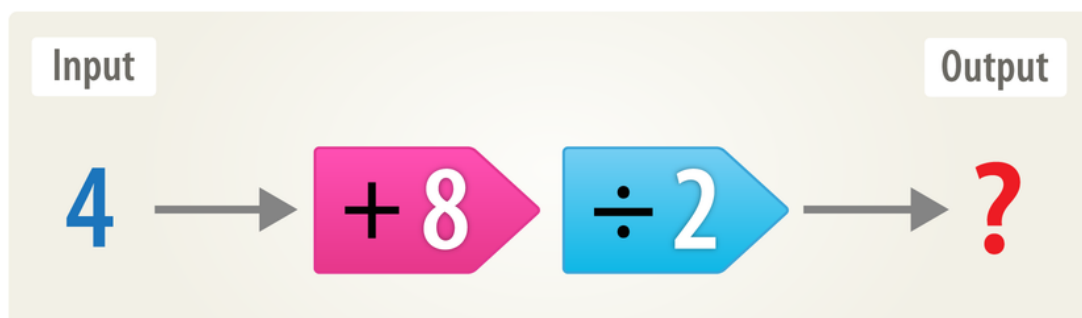
Functions - Number machines

Function machines with numbers   **M175**

What should replace the question mark to complete the function machine?

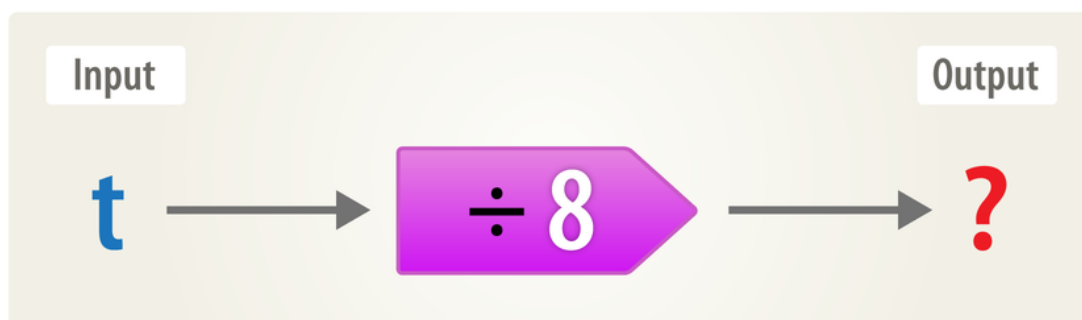Input   Output

8 ⟶ + ? ⟶ 11

Work out the output of this function machine.

Input   Output

4 ⟶ + 8   ÷ 2 ⟶ ?

Work out the input of this function machine.

Input → ? → +4 → ×3 → Output 15

Function machines with letters   **M428**

What is the output of this function machine?

Input t → ÷8 → Output ?

Find the input of the function machine below.

Input

? → ×5 → 5p

Output

What is the output of the function machine below?

Input

c → ×7 → −13 → ?

Output

Work out the output of the function machine.

Input

Output

$y \longrightarrow \boxed{\div\ 6} \boxed{-\ 34} \longrightarrow \textbf{?}$
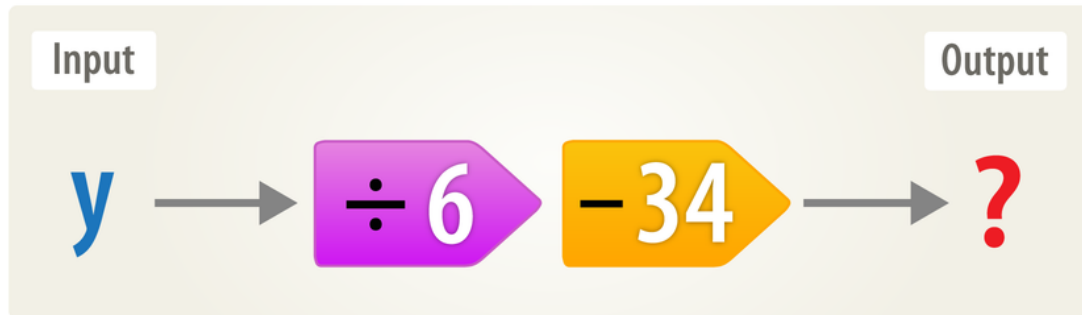
Sequences - Linear sequence

Term-to-term rules   **U213**

The terms in this sequence increase by the same amount each time.
Work out the three missing terms to complete the sequence.

$$5 \rightarrow \underline{\hspace{1em}} \rightarrow \underline{\hspace{1em}} \rightarrow \underline{\hspace{1em}} \rightarrow 17 \rightarrow$$

The start of a sequence is shown below. Copy and complete the rule for this sequence.

Rule:

Start at [ ]

Multiply by [ ] then subtract 1 each time

$$7 \rightarrow 13 \rightarrow 25 \rightarrow 49 \rightarrow$$

What is the value of the first term in the sequence below?

Rule:

Start at ?

Add 3 then divide by 2 each time

5 → 4 → 3.5 →

Substituting into position-to-term rules   **U530**

The expression for the nth term of a sequence is $3n + 8$

What are the **first three terms** in the sequence? Give your answers in order.
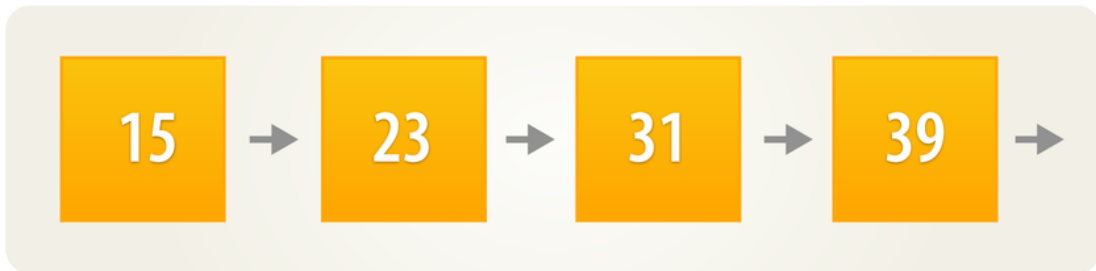
The nth term of a sequence is given by $T(n) = 4n + 5$

a) Work out the 2nd term in this sequence.
b) Work out the 6th term in this sequence.
c) Work out the 8th term in this sequence.

Position-to-term rules for arithmetic sequences

U498

The beginning of an arithmetic sequence is shown below.
By first working out the nth term rule, calculate the 11th term of this sequence.

| 15 | → | 23 | → | 31 | → | 39 | → |

The start of an arithmetic sequence is shown below.
What is the nth term rule for this sequence?

The nth term rule is ☐ n − ☐

| 2 | → | 9 | → | 16 | → | 23 | → |

Position-to-term rules for sequences of patterns   **U978**

The start of a sequence of patterns made from sticks is shown below. The same number of sticks is added each time.

What is the rule for the number of sticks in the nth pattern?

Sticks in n^th pattern: [   ]

Pattern number, n	1	2	3	...
Pattern				...